

## COMMUNICATION APPARATUS

### BACKGROUND OF THE INVENTION

#### Field of the Invention

5           The present invention relates to a  
communication apparatus for detecting a hook-state of  
a second communication means such as a telephone set  
in facsimile apparatus and data communication  
apparatus that can be utilized by connecting the  
10 second communication means thereto.

#### Related Background Art

##### <Conventional Example 1>

FIG. 6 is a diagram showing a conventional  
communication apparatus 600.

15           This conventional communication apparatus 600  
is utilized in such configuration that communication  
means CS61 and CS62 are connected to one analog  
public line (PSTN: Public Switched Telephone Network),  
and a telephone set defined as the second  
20 communication means CS62 is connected to a facsimile  
apparatus defined as the first communication means  
CS61.

In the conventional communication apparatus 600,  
a line connects to terminals L1 and L2, while the  
25 telephone set connects to terminals T1, and T2. The  
first communication means CS61 includes a MODEM 64  
(which is a facsimile MODEM or a data communication

MODEM) and thus performs communications.

Then, a CML relay 61 is provided as a first switch means, and the telephone set or the MODEM 64 of the first communication means CS61 can be used by  
5 connecting the line to the side of the telephone set or the side of the MODEM 64 of the first communication means CS61.

Namely, the line, if the CML relay 61 is switched OFF, connects to the telephone set and, if  
10 switched ON, connects to the MODEM 64, whereby the telephone set or the MODEM 64 can operate.

A transformer 63 transmits analog signals for communications. A DC capture unit 62 allows a DC current from a telephone line to flow, whereby an  
15 exchanger of a telephone office recognizes that the communication apparatus is establishing the connection with the line.

When the CML relay 61 connects to the ON-side, the line is connected to the transformer 63 and the  
20 DC capture unit 62 of the first communication means CS61, and therefore the facsimile apparatus as the first communication means becomes capable of performing the communications through the MODEM 63.

In this case, since the line is single, only  
25 one of the facsimile apparatus and the telephone set is usable, and the facsimile apparatus is therefore required to monitor a line active state (on-hook/off-

hook-state) of the telephone set at all times.

In the case of detecting a hook-state of the telephone set, a current flowing when the telephone set is off-hooked, is flowed to a HOOK detector 66,  
5 and hook detection of the telephone set is conducted based on a HOOK signal outputted from this HOOK detector 66.

The HOOK detector 66 is constructed of a current sensor, a current detection relay, etc. that  
10 utilize a photo coupler, a Hall-effect device or the like.

Namely, a line DC voltage is applied to a connecting unit of the telephone set as the second communication means CS62 through the facsimile  
15 apparatus as the conventional communication apparatus 600, or the voltage is applied to the connecting unit from a DC power source 67 within the facsimile apparatus. When the telephone set is in its on-hook-state, the current does not flow, and hence the HOOK  
20 detector 66 does not output the HOOK signal. While on the other hand, when the telephone set is in its off-hook-state, a proper current flows, and the HOOK detector 66 outputs the HOOK signal. Accordingly, the facsimile apparatus as the conventional  
25 communication apparatus 600 becomes capable of detecting the hook-state of the telephone set as the second communication means CS62.

The HOOK detector 66, normally when a DC current on the order of 5 to 10 mA flows, determines that the off-hook is detected.

On the other hand, a second switch (H relay 65)  
5 is provided inside the facsimile apparatus and, when the telephone set is switched over to the line side or the DC power source 67 within the facsimile apparatus, the following operations can be actualized.

The first switch (CML relay 61) is connected to  
10 the side of the telephone set (OFF-side), and the second switch (H relay 65) is connected to the line side (OFF-side), whereby the telephone set comes to a usable state, and the hooking can be detected based on the line DC voltage. Namely, it is feasible to  
15 detect the hook-state in a wait state and in the telephone usable state.

Further, if the second switch (H relay 65) is connected to the side (ON-side) of the DC power source 67 in the facsimile apparatus irrespective of  
20 the connecting direction of the first switch (CML relay 61), the hook detection of the telephone set can be attained based on the DC power source 67 within the facsimile apparatus. Accordingly, the hook detection of the telephone set can be done when  
25 the facsimile apparatus is in the operation state as well as in the case of the facsimile apparatus being in the wait state.

Moreover, if a calling signal is received from the line when in the wait state, this calling signal reaches the telephone set in the case where the second switch (H relay 65) is connected with the line side, with the result that the telephone set rings. Whereas if the second switch (H relay 65) is connected to the side of the DC power source 67 within the facsimile apparatus, the calling signal does not arrive at the telephone set, and the telephone set does not ring.

Any one of these cases can be selected by control or setting of the facsimile apparatus.

Further, Japanese Patent Application Laid-Open No. 1-129649 discloses that a detecting means for detecting a state of a speech means is provided with an applying means for applying a voltage from the line, and the detecting means detects the state of the speech means on the basis of the voltage applied by the applying means.

Moreover, Japanese Patent No. 3055343 discloses a facsimile apparatus provided with an invalidating means for invalidating a calling signal for ringing of an extension (or subsidiary) phone by use of unidirectional devices and, besides, capable of detecting a hook-state of the subsidiary phone.

According to the conventional example described above, in the case of applying the DC power source of

the facsimile apparatus as the conventional communication apparatus 600 to the connecting unit of the telephone set as the second communication means CS62, if the secondary DC power source provided  
5 inside the conventional communication apparatus 600 is utilized as it is, it is required that this DC power source be separated by insulation from other secondary circuits of the conventional communication apparatus 600. If a circuit for this insulating  
10 separation is provided, there arises a problem, wherein this circuit is costly and needs both a wider space for use and extra electric power of consumption.

Further, according to the conventional example given above, internal noises of the conventional  
15 communication apparatus 600 are easy to occur in the second communication means CS62 and on the line as well. Then, there arises a necessity of providing a noise preventive circuit for restraining those noises. A problem in the case of providing this noise  
20 preventive circuit is that this circuit is costly and needs its space.

Moreover, according to the conventional example described above, when using the telephone set as the second communication means CS62, for assuring an  
25 operation thereof, the HOOK detector is required to meet the standards of the line for using the telephone set. Namely, there is a necessity of

meeting the standards such as "insertion loss"  
defined as a standard for restraining a signal loss  
in a voice band, "series DC resistance" defined as a  
standard for restraining a resistance value between  
5 the line connecting unit of the conventional  
communication apparatus 600 and the connecting unit  
of the telephone set as the second communication  
means CS62, i.e., between a terminal L1/L2 and a  
terminal T1/T2 in the conventional communication  
10 apparatus 600, and so forth.

If it is required to detect the off-hook of the  
telephone set as the second communication means CS62  
by use of a current value smaller than 5 to 10 mA,  
however, even though the HOOK detector is constructed  
15 as the standards require, there is still such a  
problem that it is difficult to meet the above  
standards simultaneously.

Further, the conventional method disclosed in  
Japanese Patent Application Laid-Open No. 1-129649,  
20 provides one single means for detecting a state of  
the speech means, and in this case only one type of  
detection sensitivity can be actualized. There might  
be a case where the state of the speech means cannot  
be detected depending on a level of the line voltage.  
25 For example, when a line relay (CML) is connected to  
a MODEM unit 1, the line current flows to the MODEM  
unit 1. But, in the case of turning on a H relay at

the same time to detect the state of a telephone set 2, especially the off-hook, if a DC impedance of the telephone set 2 is higher than a DC impedance of the MODEM unit 1, the DC current flowing to the side of  
5 the telephone set 2 becomes smaller than the current needed for an off-hook-state detecting means of the telephone set 2. This causes a problem in which the off-hook of the telephone set 2 cannot be detected.

Moreover, according to the conventional method  
10 described above, there is no means for preventing the telephone set to ring, so that when the communication apparatus is not in the operation state, the arrived calling signal invariably reaches the telephone set, resulting in such a problem that the telephone set is  
15 to ring in the case where the telephone set is not desired to ring.

Further, according to the conventional method disclosed in Japanese Patent No. 3055343, one off-hook detecting circuit is provided for one extension  
20 phone, and therefore the same problem as the above might occur.

Still further, in the conventional example explained above, when scheming to solve the aforementioned problems, there are required a means  
25 for detecting a polarity of the telephone line and a polarity matching means for matching the polarity of the telephone line with a polarity of the extension



phone on the basis of the detected polarity. This configuration conduces to a problem of increasing the number of internal circuits of the apparatus and the costs thereof, enlarging a circuit space and causing  
5 a rise in the electric power of consumption.

<Conventional Example 2>

FIG. 14 is a block diagram showing an NCU 1200 used for a conventional facsimile apparatus FS11 to which the telephone set can be connected.

10 The NCU 1200 used for the conventional facsimile apparatus FS11 is, as illustrated in FIG. 14, provided with a DC power source 218 for exclusive use of detecting the off-hook of the telephone set.

Namely, during a period for which the facsimile  
15 apparatus FS11 is capturing the line and a period for which the facsimile apparatus FS11 sets the telephone set in a non-ringing state, the telephone set is disconnected from the line in order to eliminate an influence of the telephone set, and the dedicated DC  
20 power source 218 is provided for detecting the off-hook of the telephone set in this state also.

Next, an operation of the conventional facsimile apparatus FS11 will be discussed.

In a normal wait state, both of a CML relay 212  
25 and an H relay 216 are switched OFF, and the telephone set connected to the terminal T1/T2 is connected with the line connected to the terminal

L1/L2. Accordingly, when the telephone set is off-hooked, the current flows from the line, and the off-hook can be detected based on an output signal of a HOOK detector 215.

5           During the capture of the line, however, the CML relay 212 is switched ON, and the signal from the line is led to an interior of the FAX via a transformer 213. Therefore, during a wait for non-ringing setting (for preventing the telephone set  
10 connected to the terminal T1/T2 from ringing triggered by a CI signal), the H relay 216 is switched ON in order to restrain the telephone set from ringing triggered by the calling signal, so that the telephone set is disconnected from the line with  
15 the result that the hooking can not be detected based on the current flowing from the line.

          Such being the case, in the facsimile apparatus FS11, a DC power source 218 for detecting the hooking is provided on the ON-side of the H relay 216,  
20 thereby detecting the hook-state on the basis of the current from the DC power source 218.

          In the conventional facsimile apparatus FS11, however, the DC power source 218 is normally incorporated into a power unit, and a problem is that  
25 the DC power source 218 itself is a factor for increasing the costs of the power unit. Further, in the conventional facsimile apparatus FS11, a cable

and a connector are needed for connecting the power unit to the NCU (network control circuit unit), and hence there arises a problem in which steps for connecting these components are required, and this is  
5 also a factor for further increasing the costs.

For eliminating those factors for raising the costs, there is proposed a circuit for detecting the hooking by use of a current from the line during the capture of the line and also during the waiting in  
10 the non-ringing setting.

According to the conventional facsimile apparatus FS11, however, the DC power source 218 is normally incorporated into the power unit, the problem is that the DC power source 218 itself is the  
15 factor for increasing the costs of the power unit. A further problem is that the connector is needed for connecting the power unit to the NCU (network control circuit unit), and steps for connecting these components are required, which causes a large  
20 increase in the costs.

#### SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a communication apparatus that can be  
25 actualized at low costs and can save its space in communication apparatuses that connect to an analog public line for communication.

It is therefore a major object of the present invention to decrease costs of the apparatus by executing a hook detection by utilizing a current from a line even during a capture of the line and  
5 during a wait in non-ringing call receipt setting (for preventing a telephone set connected to a terminal T1/T2 from ringing triggered by a CI signal).

It is another object of the present invention to remove an influence of the telephone set that is  
10 in the process of communications and dialing, which is to occur due to an execution of the hook detection using the current from the line.

It is still another object of the present invention to detect the hooking of the telephone set  
15 while eliminating the influence of the telephone set during the communications and the dialing, and to surely detect that the dialing is suspended midways.

It is a further object of the present invention to provide a communication apparatus having no DC  
20 power source dedicated for hook detection, capable of surely detecting a hook-state during off-hook dialing, and capable of eliminating mis-dialing in the case where when dialing is executed from a FAX side in an off-hook-state of the telephone set and a mistake is  
25 noticed in inputting a telephone number, a correct telephone number is entered after on-hooking/off-hooking of the telephone set.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a circuit diagram showing a communication apparatus 100 according to a first embodiment of the present invention;

5        FIG. 2 is a circuit diagram showing a communication apparatus 200 according to a second embodiment of the present invention;

FIG. 3 is a circuit diagram showing one example of a current rectifier 20;

10        FIG. 4 is a circuit diagram showing a communication apparatus 300 according to a third embodiment of the present invention;

FIG. 5 is a circuit diagram showing a communication apparatus 400 according to a fourth  
15        embodiment of the present invention;

FIG. 6 is a diagram showing a conventional communication apparatus 600;

FIG. 7 is a block diagram showing an NCU 100 used for a facsimile apparatus FS1 according to one  
20        embodiment of the present invention;

FIG. 8 is a block diagram showing a configuration of the facsimile apparatus FS1 as one embodiment of the present invention;

FIG. 9 is a flowchart showing control  
25        operations of a variety of relays;

FIG. 10 is a flowchart showing the control operations of the variety of relays;

FIG. 11 is a flowchart showing an off-hook dialing operation in the embodiment described above;

FIG. 12 is a timing chart showing an operation in the embodiment described above;

5        FIG. 13 is a flowchart showing a hook determination processing operation in the embodiment described above; and

FIG. 14 is a block diagram showing an NCU 1200 used for a conventional facsimile apparatus FS11 to  
10        which a telephone set can be connected.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

##### <First Embodiment>

FIG. 1 is a block showing a communication  
15        apparatus 100 according to a first embodiment of the present invention.

The communication apparatus 100 includes a first communication means CS11 and further has a modular connector, etc., defined as a connecting  
20        means for connecting a second communication means CS12. The first communication means CS11 is defined as a communication means for performing, for example, facsimile communications. The second communication means CS12 is a telephone set.

25        The communication apparatus 100 is connected via two lines L1, L2 to an analog public line. The telephone set defined as the second communication

means CS12 is connected to the communication apparatus 100 via two lines T1, T2 as a connecting means of the second communication means.

The facsimile apparatus as the communication  
5 apparatus 100 includes a CML relay 11, the first communication means CS11, an H relay 15, a first route means (or first path means) 16, a second route means (or second path means) 17, and HOOK detectors 18, 19. The first communication means CS11 has a DC  
10 capture unit 12, a transformer 13 and a MODEM 14.

The CML relay 11 is an example of a first switch means and connects, when connected to an OFF-side, the line to the telephone set side defined as the second communication means CS12. In the case of  
15 connecting the CML relay 11 to an ON-side, the line is connected to the MODEM 14 (which is herein a facsimile MODEM) defined as the first communication means. Namely, the CML relay 11 is connected to the OFF-side in a wait state where the facsimile  
20 apparatus remains non-operated and in a state where the telephone set is operating. The CML relay 11 is connected to the ON-side when the facsimile apparatus performs communications through the MODE 14.

The first route means 16 is a couple of wires  
25 for establishing a connection to the telephone set side via the CML relay 11 from L1, L2.

The transformer 13 transmits analog signals for

communications. The DC capture unit 12 permits a DC current of the telephone line to flow, whereby an exchanger of a telephone office recognizes that the communication apparatus is establishing the  
5 connection of the line.

When the CML relay 11 is connected to the ON-side, the line is connected to the transformer 13 and the DC capture unit 12 that are defined as the first communication means CS11, and hence the facsimile  
10 apparatus becomes capable of the communications through the MODEM 14.

The H relay 15 is an example of a second switch means. The H relay 15 is a relay, connected between the CML relay 11 of the first route means 16 and the  
15 telephone set, for connecting the telephone set to any one of the first route means 16 and the second route means 17.

The second route means 17 is a route (or path) branching from L1, L2 for connecting the line, and  
20 connects L1, L2 to the H relay 15 through two wires. Accordingly, when the H relay 15 is connected to the OFF-side and when the CML relay 11 is connected to the OFF-side, the telephone set is connected to the line via the first route means 16. When the H relay  
25 15 is connected to the ON-side, irrespective of which side the CML relay 11 is connected to, the telephone set can be connected to the line via the second route



means 17.

The first HOOK detector 18 is connected between the CML relay 11 of the first route means 16 and the H relay 15. The first HOOK detector 18 executes a  
5 hook detection of the telephone set when the telephone set is connected to the line via the first route means 16.

The second HOOK detector 19 is connected between a branch point on the second route means 17  
10 and the H relay 15. The second HOOK detector 19 executes the hook detection of the telephone set when the telephone set is connected to the line via the second route means 17.

Each of the first HOOK detector 18 and the  
15 second HOOK detector 19 is constructed of a current sensor, a current detection relay, etc. which utilize a photo coupler, a Hall-effect device or the like. A level of a HOOK1 signal outputted by the first HOOK detector 18 and a level of a HOOK2 signal outputted  
20 by the second HOOK detector 19, are determined depending on the DC current flowing therethrough. An unillustrated CPU of the first communication means CS11 checks the level of the HOOK1 signal and the level of the HOOK2 signal, and thus judges whether  
25 the telephone set is in an on-hook or off-hook-state.

Namely, when the telephone set is in the on-hook-state, the current flows through neither the

first HOOK detector 18 nor the second HOOK detector 19, and hence the HOOK1 signal and the HOOK2 signal come to, for example, a Low level. On the other hand, when the telephone set is in the off-hook-state, the  
5 current flows through the first HOOK detector 18 (or the second HOOK detector 19), with the result that the HOOK1 signal (or the HOOK2 signal) becomes a High level in contrast with the above.

When the telephone set is off-hooked from the  
10 on-hook-state or is on-hooked from the off-hook-state, the level of the HOOK1 signal or of the HOOK2 signal change. But, a hook-state determining timer is provided for eliminating chattering of a hook switch of the telephone set and a delay of change in the  
15 current due to RC (resistance and capacitance) within the telephone set.

To be specific, when the HOOK1 signal or the HOOK2 signal changes to the High level from the Low level, the timer is started. If the High level  
20 continues without any interruption for, e.g., 500 ms, it is judged that a change from the on-hook-state to the off-hook-state is made in the telephone set.

If the first HOOK detector 18 and the second HOOK detector 19 are constructed of the photo  
25 couplers, this involves using bidirectional photo couplers that do not restrict the direction of the DC current. In the case of the current sensor and the

current detection relay, the direction of the DC current is not likewise restricted.

Next, an operation of the embodiment discussed above will be explained.

5           In a wait state, the CML relay 11 is connected to the OFF-side, and therefore the hook detection of the telephone set can be attained even when the H relay 15 is connected to either the OFF-side or the ON-side. Namely, if the H relay 15 is connected to  
10 the OFF-side, it follows that the telephone set is connected to the first route 16. When the telephone set is in its off-hook-state, the current flowing via the first route 16 from the line further flows through the first HOOK detector 18, and the HOOK1  
15 signal assumes the High level, whereby the off-hook of the telephone set can be detected.

As a matter of course, no current flows, and hence the HOOK1 signal comes to the Low level, whereby the on-hook can be detected. Furthermore, if  
20 the H relay 15 is connected to the ON-side, it follows that the telephone set is connected to the second route 17. When the telephone set is in its off-hook-state, the current flowing via the second route 17 from the line further flows through the  
25 second HOOK detector 19, and the HOOK2 signal takes the High level, whereby the off-hook of the telephone set can be detected.

As described above, when the telephone set is in the on-hook-state, the current does not flow, and consequently the HOOK2 signal comes to the Low level, whereby the on-hook can be detected.

5       Accordingly, the embodiment discussed above does not require a DC power source within the apparatus that has been required in the conventional apparatus, and does not therefore necessitate a noise eliminating circuit either, which should eliminate  
10       noises caused by the DC power source given above.

When the telephone set is off-hooked from the wait state, the CML relay 11 continues the off-connection, while the H relay 15 continues the off-connection or establishes the off-connection from the  
15       on-state and thus connects the telephone set to the line by connecting the telephone set to the first route means 16, thereby assuring the utility (speech) of the telephone set with no problem. At this time, in the case of detecting the on-hook of the telephone  
20       set, the first HOOK detector 18 detects the on-hook of the telephone set.

On the other hand, the CML relay 11 is connected to the ON-side, and, if necessary for detecting the hooking of the telephone set during  
25       some operation of the facsimile apparatus, the H relay 15 is connected invariably to the ON-side while the telephone set is connected to the second route

means 17.

The H relay 15 is connected to invariably to the ON-side to connect the telephone set to the second route means 17, in cases such as when the facsimile apparatus is provided with a hook key and this hook key is pressed to set the CML relay to the on-state; before dialing after switching on the CML relay 11 in order for the facsimile apparatus to enter a dial operation; after switching on the CML relay 11 in order to detect a CNG signal after a calling signal has arrived in a FAX/TEL selection mode; when outputting a dial signal from the facsimile apparatus in the off-hook state of the telephone set; when outputting a hang-on tone and a voice answering signal from the MODEM 14 by switching on the CML relay 11; and so on.

Accordingly, when the telephone set is in the off-hook-state, the current flowing via the second route means 17 from the line is made to flow through the second HOOK detector 19, thereby making it possible to detect the off-hook of the telephone set. As a matter of course, the current does not flow through the second HOOK detector 19 when the telephone set is in the on-hook-state, whereby the on-hook can be detected.

Further, the following case is given as the operation of the first embodiment.

If required for detecting the hooking of the telephone set when the CML relay 11 is kept on, the telephone set is connected to the second route means 17 by switching on the H relay 15, and the hook  
5 detection is carried out. In this state, however, if the telephone set is off-hooked and an influence is exerted on the operation of the facsimile apparatus, the telephone set is disconnected from the second route means 17 by switching off the H relay 15, thus  
10 disconnecting the telephone set from the line. For instance, the telephone set and the facsimile apparatus are connected in parallel to the line, there changes a characteristic on the side of the facsimile apparatus, and the operation of the  
15 facsimile apparatus is influenced. In this case, when the facsimile apparatus is in the process of performing the communications and transmitting the dial signal, the H relay 15 is switched off, and the telephone set is disconnected from the second route  
20 means 17.

As described above, the first HOOK detector 18 is attached to the first route means 16 and the second HOOK detector 19 is attached to the second route means 17; these detectors are further  
25 structured as follows.

The first HOOK detector 18 exists on the first route means 16 to be connected when the telephone set

is in a state of being used, and hence a current value that meets the aforementioned standards and besides serves to detect the off-hook of the telephone set, is set to approximately 5 through 10  
5 mA in order to assure the specifications of the telephone set. Accordingly, as there are no influences on the facsimile communications and dialing in the facsimile apparatus, the inexpensive photo coupler, etc. can be utilized as the first HOOK  
10 detector 18.

On the other hand, the second HOOK detector 19, if required for detecting the hooking of the telephone set when the CML relay 11 is kept on, might detect the hooking by connecting the telephone set to  
15 the second route means 17, and is therefore structured as follows.

Namely, when the CML relay 11 is kept on, the telephone set is connected to the second route means 17, and the telephone set is off-hooked, resulting in  
20 such a state that the DC capture unit 12 of the facsimile apparatus and the telephone set are connected in parallel. At this time, if a DC impedance of the DC capture unit 12 is smaller than that of the telephone set. In this case also, there  
25 is a necessity of detecting the hooking. Accordingly, the second HOOK detector 19 is, even when the current flowing to the telephone set is a small current,

structured to detect the off-hook. To be specific,  
the second HOOK detector 19 is structured to judge  
that the telephone set is off-hooked in a case where  
the current on the order of several hundreds of  
5 microamperes ( $\mu$ A) through 1 mA flows to the telephone  
set.

Even if the second HOOK detector 19 is  
structured to detect the off-hook of the telephone  
set on the basis of the small current, as described  
10 above, the timer determining means is provided, and  
hence when the timer comes to a full status and is  
going to determine, the capacitor within the  
telephone set is sufficiently charged therefore, even  
when the line is connected to the telephone set by  
15 switching over the CML relay 11 to the off-state from  
the on-state, it does not happen that the exchanger  
of the telephone office detects the on-hook by  
mistake due to a cut-off of the line current.

As the detection of the hooking of the  
20 telephone set involves using the second route means  
17, in a state where the telephone set is connected  
to the second route means 17 including the second  
HOOK detector 19, there is no necessity of meeting  
the standards described above, and it is possible to  
25 actualize the small current serving to detect the  
off-hook. The second HOOK detector 19 is connected  
so as not to exert any influence on the facsimile



communications, the dialing, etc. by the facsimile apparatus, and therefore the inexpensive photo coupler can be utilized.

Herein, an unillustrated control means such as  
5 a CPU, etc. of the facsimile apparatus controls the variety of relays given above.

<Second Embodiment>

FIG. 2 is a block diagram showing a communication apparatus 200 according to a second  
10 embodiment of the present invention.

The communication apparatus 200 includes a first communication means CS21 and further has a modular connector, etc., defined as a connecting means for connecting a second communication means  
15 CS22. The first communication means CS21 is defined as a communication means for performing, for example, the facsimile communications. The second communication means CS22 is a telephone set as the second communication means CS12.

20 Moreover, the second route means 17 of the communication apparatus 200 has a current rectifier 20. The current rectifier 20 exists on the second route means 17 and is provided closer to the line than the H relay 15.

25 FIG. 3 is a circuit diagram showing one example of the current rectifier 20.

The current rectifier 20 uses, as illustrated

in FIG. 3, four pieces of unidirectional devices  
(e.g., diodes). In this current rectifier 20, anode  
and cathode connecting terminals of the diodes with  
no polarity are connected to the line-side, while an  
5 anode connecting terminal (-) and a cathode  
connecting terminal (+) each exhibiting a polarity  
are connected to the side of the H relay 15. With  
this contrivance, the unidirectional DC current can  
be obtained on the side of the H relay 15 without  
10 depending on the polarity of the DC current flowing  
from the line, and the Hook detection by the second  
HOOK detector 19 can be actualized without any  
problem.

In particular, the second HOOK detector 19 is  
15 disposed closer to the H relay 15 than the current  
rectifier 19, and hence the direction of the DC  
current through the line becomes fixed. Accordingly,  
the unidirectional photo coupler can be utilized, and  
costs can be reduced down owing to the bidirectional  
20 photo coupler. The current sensor and the DC  
detection relay have likewise no limit in the  
direction of the DC current and can be, even if  
limited in terms of the direction of the DC current,  
each used as the second HOOK detector 19.

25 Further, when the facsimile apparatus as the  
communication apparatus 200 is in its wait state, the  
telephone set as the second communication means CS22

is connected to the second route means 17 by  
switching on the H relay 15. Hereupon, even when a  
calling signal having positive and negative voltage  
levels of 15 Hz to 60 Hz arrives from the line, the  
5 current rectifier 20 rectifies this signal into a  
half-wave assuming only the positive voltage level,  
thereby invalidating the calling signal with the  
result that a ringer provided inside the telephone  
set does not ring. Namely, even if there is not  
10 provided the DC power source that has hitherto been  
provided inside the facsimile apparatus in the  
conventional apparatus, the calling signal can be  
invalidated without the telephone set's ringing in  
the state of being connected to the line.

15 While on the other hand, when in the wait state,  
the H relay 15 is switched off, and the telephone set  
is connected to the first route means 16. Hereupon,  
the calling signal arrived from the line reaches  
directly the telephone set, and the telephone set  
20 rings with no problem.

The connection of the H relay 15 in the wait  
state is based on initialization of the facsimile  
apparatus.

As described above, the current rectifier 20 is  
25 provided on the second route means 17, and hence even  
if the calling signal arrives just when switching on  
the H relay 15, the telephone set does not ring.

Further, the current rectifier 20 is constructed by using the four pieces of unidirectional devices, so that the off-hook of the telephone set can be detected with no problem without adding any extra  
5 circuits irrespective of the direction of the DC current of the line.

<Third Embodiment>

FIG. 4 is a block diagram showing a communication apparatus 300 according to a third  
10 embodiment of the present invention.

The communication apparatus 300 includes a first communication means CS31 and further has a modular connector, etc., defined as a connecting means for connecting a second communication means  
15 CS32. The first communication means CS31 is defined as a communication means for performing, for example, the facsimile communications. The second communication means CS32 is a telephone set as the second communication means CS12.

20 Moreover, the second route means 17 of the communication apparatus 300 has an H detection relay 21. The H detection relay 21 exists on the second route means 17 and is provided closer to the line than the H relay 15 in the communication apparatus  
25 300. In the communication apparatus 300, the H detection relay 21 is attached to one of two wires and may also be attached to both of the two wires.

When switching on the H detection relay 21, the second route means 17 is connected. When switching off the H relay 21, the second route means 17 is disconnected. Other configurations are the same as those in the communication apparatus 200.

Next, a control operation in the communication apparatus 300 will be explained.

If required for detecting the hooking of the telephone set as the second communication means CS32 when the CML relay 11 is kept on, the telephone set is connected to the second route means 17 by switching on the H relay 15, and the second HOOK detector 19 detects the hooking. In the state where the telephone set is off-hooked and an influence exerts on the operation of the facsimile communication means as the first communication means CS31, if necessary for switching on the H relay 15, the H detection relay 21 is switched off and the second route means 17 is disconnected. Namely, the telephone set is separated from the line.

For instance, the telephone set as the second communication means CS32 and the facsimile communication means as the first communication means CS31, are connected in parallel to the line, and the characteristic on the side of the facsimile apparatus changes large enough to exert the influence on the operation thereof. In this case, for example, when

the facsimile apparatus is in the process of performing the communications and transmitting the dial signal, the H detection relay 21 is switched off, and the second route means 17 is disconnected.

5           According to the communication apparatus 300, as discussed above, the H detection relay 21 is provided and is capable of separating the second route means 17. Therefore, even when the telephone set is off-hooked in the case where the facsimile  
10           apparatus is in the process of performing the communications and transmitting the dial signal, the telephone set can be separated from the line so as not to cause the influence due to the aforementioned operation of the telephone set.

15           Further, as explained above, in the case of switching off the H relay 15 as a substitute for the H detection relay 21, the H relay 15, if constructed as a mechanical relay, emits a large switchover noise that might, if frequently switched over, get on the  
20           user's nerves. Hence, if controlled by providing the H detection relay 21, the H relay 15 becomes capable of keeping its on-state and does not emit, even if constructed as the mechanical relay, the switchover noise thereof.

25           Herein, the control of the variety of relays is conducted by the unillustrated control means such as the CPU, etc. of the facsimile apparatus.

<Fourth Embodiment>

FIG. 5 is a circuit diagram showing a communication apparatus 400 according to a fourth embodiment of the present invention.

5       The communication apparatus 400 includes a first communication means CS41 and further has, e.g., a modular connector, etc., defined as a connecting means for connecting a second communication means CS42. The first communication means CS41 is defined  
10 as a communication means for performing, for example, the facsimile communications. In the communication apparatus 400, the first communication means CS41 is a device including the first HOOK detector 18 shifted to between L1, L2 for connecting the line and the CML  
15 relay 11. The second communication means CS42 is a telephone set as the second communication means CS32.

Other configurations and operations are the same as those explained in the communication apparatuses 100, 200, 300, wherein there is no  
20 problem even when connecting the first HOOK detector 18 to the position shown in FIG. 5, and the same effect as the above-mentioned can be acquired.

In the communication apparatus 400, the first HOOK detector 18 is connected onto the route where  
25 the facsimile operations such as the facsimile communications, dialing and so forth are performed, and is therefore constructed to meet the

characteristics thereof, i.e., constructed so as to exert no influence on the DC characteristic and the AC characteristic.

In this case, the standards (such as an  
5 insertion loss, a series DC resistance, etc.) for the telephone set can be easily met. For instance, it is possible to utilize the current sensor and the current detection relay that use the Hall-effect devices for the first HOOK detector 18. In this case,  
10 whether the line current flows or not can be detected also in the operation state of the first communication means with the first switch means kept on.

Herein, the control of the variety of relays is  
15 conducted by the unillustrated control means such as the CPU, etc. of the facsimile apparatus.

In the communication apparatuses 100, 200, 300, 400, the CML relay 11 and the H relay 15 are two-circuit relays where the two circuits operate  
20 simultaneously, however, two pieces of one-circuit relays may also be used in place of the former relays.

According to the present invention, the two types of hook detection means can be provided for detecting the hooking of the second communication  
25 means. For example, there can be separately utilized detectors having characteristics depending on applications such as those having different hook



detection sensitivities, and so on.

Further, particularly the first route means is connected and used during the operation of the second communication means, and the second route means can  
5 be used only when detecting the hooking of the second communication means. Therefore, in the state where the second communication means is connected to the second route means including the second hook detection means, there is eliminated the necessity of  
10 meeting other standards required on condition that only the hooking of the second communication means can be detected. Hence, the second hook detection means can be constructed of an inexpensive piece of hardware (for example, the photo coupler, etc.).  
15 Further, it is possible to actualize the inexpensive downsized communication apparatus consuming a smaller amount of electricity, wherein it is not required that the interior of the first communication means be provided with the dedicated DC power source that has  
20 hitherto been provided in the conventional apparatus, and therefore no noise is generated from this dedicated DC power source.

Further, according to the present invention, when the second switch means connects the second  
25 communication means to the first route means, the first hook detection means detects the hook-state of the second communication means. When the second

switch means connects the second communication means to the second route means, the second hook detection means detects the hook-state of the second communication means. Therefore, the hooking of the  
5 second communication means can be detected from the line current either in the wait state or the operation state of the first communication means. For example, in the state where the first communication means is not connected to the line,  
10 either the first hook detection means or the second hook detection means is capable of detecting the hooking of the second communication means. Moreover, if necessary for detecting the hooking of the second communication means even in the state where the first  
15 communication means is connected to the line side, the hooking thereof can be easily detected by the second hook detection means.

Furthermore, according to the present invention, the first hook detection means is connected between  
20 the first switch means on the first route means and the second switch means, and therefore this position has no influence on the communications and the dialing, etc. in the communication apparatus. It may be sufficient to meet only the characteristic of  
25 connecting the line to the second communication means and the hook detecting condition, so the first hook detection means can be constructed of the inexpensive

piece of hardware (the photo coupler, etc.).

Then, according to the present invention, the first hook detection means is connected between the telephone line and the first switch means and is  
5 therefore capable of detecting whether the line current flows or not even in the operation state of the first communication means with the first switch means kept on.

Moreover, according to the present invention,  
10 since the off-hook detection current value of the second hook detection means is smaller than the off-hook detection current value of the first hook detection means, the off-hook can be detected without any problem even if the current serving to detect the  
15 off-hook is small depending on the line condition.

Further, according to the present invention, the first communication means includes the timer determining means for judging, when the output of the hook detection means changes, that the hook-state has  
20 changed after a fixed period of time since the output changes. It is therefore feasible to eliminate the chattering of the hook switch of the second communication means and the delay of change in the current due to RC (resistance and capacitance) within  
25 the second communication means. Especially, even when the off-hook detection current is small and the capacitor inside the second communication means has

not been sufficiently charged, the capacitor is amply charged after a time of the timer has elapsed. Thus, at this time even when the line is reconnected to the second communication means from the first  
5 communication means, there is less possibility that the line is disconnected.

Then, according to the present invention, the current rectifying means constructed of four pieces of unidirectional devices is provided between the  
10 telephone line of the second route means and the second switch means, and therefore the hook detection of the second communication means through the second route means can be executed with no problem without adding any extra circuit. The second hook detection  
15 means may detect the unidirectional current, and the current detector for the unidirectional detection is employed for the hook detection means, which leads to a decrease in costs. Besides, the calling signal arrived can be converted into the half-wave, and the  
20 calling of the second communication means can be invalidated.

Moreover, according to the present invention, there is provided the means for connecting the second switch means to the first route means when the first  
25 switch means is connected to the side of the first communication means. Therefore, even when the first switch means is connected to the side of the first

communication means, it is possible to cut the connection between the telephone set and the second route means or the line as the necessity may arise. The off-hook operation of the second communication  
5 means does not exert the influence on the operation of the first communication means.

Further, according to the present invention, the second route means includes the third switch means between the telephone line and the second  
10 switch means. The third switch means is a means for connecting and disconnecting the second route means and is therefore capable of cutting the connection between the telephone set and the second route means or the line while the second switch means is kept on  
15 as the necessity may arise, so that the off-hook operation of the second communication means does not affect the operation of the operation of the first communication means.

Then, according to the present invention, when  
20 the second switch means is connected to the second route means, in the case of detecting the hook-state of the second communication means, the third switch means is set in a second route means connecting state. Therefore, if necessary for detecting the hook-state  
25 when the second switch means is connected to the second route means, the second communication means is connected to the line by connecting the third switch

means. Therefore, the current flowing from the line  
can be made to flow even when the second  
communication means is off-hooked, whereby the hook  
detection of the second communication means can be  
5 executed with no problem.

Further, according to the present invention,  
the first switch means is connected to the first  
communication means, and, during the operation of the  
first communication means, the third switch means  
10 disconnects the second route means. Accordingly,  
even when the first switch means operates to connect  
the first communication means to the circuit side, it  
is possible to cut off the connection between the  
second communication means and the second route means  
15 or the line while the second switch means is kept on  
as the necessity may arise. Therefore, the off-hook  
operation of the second communication means does not  
affect the operation of the operation of the first  
communication means.

20 Moreover, according to the present invention,  
the first communication means involves the use of the  
MODEM, and the second communication means is the  
telephone set, so that a data communication apparatus  
can be utilized as the first communication means in  
25 place of the facsimile apparatus.

The present invention exhibits such an effect  
that the communication apparatus utilized by its

being connected to the analog public line can be actualized in a manner that reduces its costs and saves its space.

<Fifth Embodiment>

5        FIG. 7 is a block diagram showing an NCU 100 employed for a facsimile apparatus FS1 according to one embodiment of the present invention.

10        The fifth embodiment will exemplify a facsimile apparatus and may be applied to any communication apparatus other than the facsimile apparatus on condition that the telephone set be connectable to the communication apparatus.

15        The symbols L1 and L2 represent terminals for connecting the telephone line, and T1 and T2 are terminals for connecting a communication apparatus such as the telephone set or a handset of the telephone set, etc. to the facsimile apparatus FS1.

20        The NCU 100 is a network control circuit used for the facsimile apparatus FS1 and includes a diode bridge 1, a P relay 2, a CML relay 3, a transformer 4, a two-four wire converting circuit 5, HOOK detectors 6 and 8, an H relay 7, an H detection relay 9 and an CI detecting circuit 10.

25        The diode bridge 1 is a diode bridge for rectifying a signal transmitted from the telephone line connected to the terminals L1/L2 and establishing a connection to the H detection relay 9.

The signal from the line is converted into a DC voltage by the bridge 1, and hence, even when the telephone line is connected to the telephone set, it does not happen that the telephone set rings in  
5 response to a calling signal. Further, since the diode bridge 1 is disposed in a position closer to the terminals L1/L2 of the telephone line than the CML relay 3, when the telephone set is off-hooked even if the CML relay 3 is in an off-state (which  
10 implies that the facsimile apparatus FS1 is disconnected from the telephone line), the off-hook can be surely detected from a line current.

The P relay 2 is a relay for transmitting a dial pulse. The CML relay 3 is a relay for capturing  
15 or disconnecting the line. The transformer 4 is a transformer for forming a DC loop, capturing the line and taking in an AC component.

The two-four wire converting circuit 5 is a circuit for executing a two-four wire conversion of  
20 the signal received via the transformer 4. Through this two-four wire converting circuit 5, the signal can be transmitted and received between the line and the unillustrated MODEM existing in the facsimile apparatus FS1.

25 The HOOK detector 6 is a HOOK detector for detecting the hook-state when both of the CML relay 3 and the H relay 7 are switched OFF. The HOOK



detector 6 performs the hook detection by use of the current flowing from the telephone line L1/L2. In this configuration, the line current flows to the HOOK detector 6, whereby the off-hook of the  
5 telephone set connected to the terminal T1/T2 can be detected.

The H relay 7 is a relay for switching over the telephone set connected to the T1/T2 to the line via the CML relay 3 or the H detection relay 9.

10 The HOOK detector 8 is a HOOK detector for detecting the hooking when both of the H relay 7 and the H detection relay 9 are switched ON. The HOOK detector 8 performs the hook detection by use of the current flowing from the telephone line L1/L2. In  
15 this configuration, the line current flows to the HOOK detector 8, whereby the off-hook of the telephone set connected to the terminal T1/T2 can be detected.

The H detection relay 9 is a relay for  
20 connecting the signal transmitted via the diode bridge 1 to the H relay 7. The H detection relay 9 is a relay for switching over a state of whether the HOOK detector 8 performs the hook detection or not when the H relay 7 is switched OFF. When the H  
25 detection relay 9 is switched OFF, the line HOOK detector 8 does not effect the hook detection.

The CI detecting circuit 10 is a detection

circuit for detecting the calling signal from the line.

The NCU 100 includes the diode bridge 1 and the H detection relay 9 in place of the DC power source 218 shown in FIG. 14, and supplies the current from the terminal L1/L2 to the ON-side of the H relay through the diode bridge 1 and the H detection relay 9.

With this configuration, as will be described alter on, even when the calling signal reaches, the telephone set connected to the terminal T1/T2 does not ring.

FIG. 8 is a block diagram showing a configuration of the facsimile apparatus FS1 in one embodiment of the present invention.

Referring to FIG. 8, an NCU 100 is the same as the NCU 100 shown in FIG. 7.

A CPU 101 is a system control unit and controls the whole apparatus. A ROM 102 serves to store a control program of the CPU 101. A RAM 103 is constructed of an SRAM (Static Random Access Memory), etc. and serves to store program control variables, etc. Further, the RAM 103 is stored with telephone set numbers of destinations and e-mail addresses of transmission destinations that have been registered by an operator, various setting values, pieces of management data of the apparatus and buffers (files)

for a variety of works.

A storage memory 104 is constructed of a DRAM (Dynamic RAM) and serves to store image data. An external display unit 105 is constructed of an LCD (Liquid Crystal Display), an LED (Light Emitting Diode), etc. and serves to notify a user of information by displaying. A speaker 106 gives a voice notification and a voice alarm to the user, and monitors a signal tone transmitted and received via a PSTN line 112. The speaker 106 has a built-in speaker control unit for switching ON and OFF the speaker.

A MODEM 107 modulates and demodulates the transmitted/received signals of the facsimile, and has a function of generating a selection signal (tone dialer). Further, the MODEM 107 configures a communication unit (to which the CPU 101, the ROM 102, the RAM 103, the storage memory 104, etc. may be added according to the necessity). A pulse dial is generated by the P relay shown in FIG. 7.

The NCU 100 has a function of transmitting the selection signal (the dial pulse or the tone dialer) to the PSTN line (analog public line network) 112, and executes an auto call receiving operation based on the detection of the calling signal. Further, the NCU 100 establishes a connection of a telephone set 117 (which may be a handset of the telephone set)

through the T1/T2 terminal shown in FIG. 7. The NCU  
100 switches ON/OFF the variety of relays in  
accordance with instructions of the CPU 101 in  
response to the detected calling signal and a hook  
5 detection signal.

A relay control unit 108 controls the variety  
of relays illustrated in FIG. 7. The numeral 109  
designates a CML relay driving unit for driving the  
CML relay. The numeral 110 represents an H relay  
10 driving unit for driving the H relay. The numeral  
111 denotes an H detection relay driving unit for  
driving the H detection relay, and 113 stands for a P  
relay driving unit for driving the P relay that  
generates the dial pulse.

15 An image processing unit 114 effects correction  
processing on image data as read and outputs fine  
image data. A scanner 115, which is constructed of a  
CS image sensor, an original carry mechanism, etc.,  
optically reads the original and converts thus read  
20 data into electrical image data. An operation unit  
116 is constructed of a keyboard, a touch panel, etc.  
and is used for an operator to perform a variety of  
input operations. Herein, the operation unit 116 has,  
in addition to an operating portion for dialing,  
25 operating portions capable of setting a ringing wait  
state, a non-ringing wait state and, as states when  
receiving the call, an F/T selection state, an auto

receiving state, a manual receiving state and so on.

A printer formatter 118, on the occasion of printing file data from a PC, a workstation and an external appliance, analyzes a printer description language and converts the data into the image data. 5 A printer 119 is an apparatus for recording the received image and the file data on a sheet of recording paper.

Next, a method of utilizing the NCU 100 will 10 briefly be explained.

The CPU 101 executes the program stored on the ROM 102, thereby conducting the following operations. The CPU 101 controls the CML relay driving unit 109, the H relay driving unit 110 and the H detection 15 relay driving unit 111 through the relay control unit 108, thereby executing ON/OFF control of the CML relay, the H relay, the H detection relay and the P relay.

FIGS. 9 and 10 are flowcharts showing how the 20 control operations of the variety of relays are conducted in the NCU 100.

The CPU 101 judges whether the ringing wait state is set or not (S201). If the ringing wait state is set, the CPU 101 switches OFF both of the 25 CML relay 3 and the H relay 7 (the states of the CML relay 3 and the H relay 7 shown in FIG. 7) in the wait state (S202). Hence, the line connected to the

terminal L1/L2 is connected directly to the telephone set connected to the terminal T1/T2 and, when the calling signal arrives from the line (S205), the telephone set 117 rings. If a manual receiving mode is set (S206) and the telephone set 117 is off-hooked (S207), both of the H relay and the H detection relay are switched OFF while the CML relay is kept OFF (S208), thereby setting the telephone set in a speech allowable state. The hook-state of the telephone set is monitored by the HOOK detector 6. Upon detecting an end of the speech (S209), each of the relays is initialized, thus terminating the operation (S210).

Next, the CPU 101 judges whether the non-ringing wait state is set or not (S203). If the non-ringing wait state is set, the CPU 101 switches OFF the CML relay 3 but switches ON the H relay 7 and the H detection relay 9 (the H relay 7 is in the state of being connected to the HOOK detector 8 and to the H detection relay 9, while the H detection relay 9 is in the state of being connected to the diode bridge 1) (S204). The telephone set is connected to the line via the diode bridge 1 and the H detection relay 9.

In this circuitry, the signal from the line is rectified through the diode bridge 1, and the direct current is outputted. Hence, when the calling signal reaches from the line, the telephone set 117 does not

ring, but the hook-state of the telephone set 117 can be grasped through the HOOK detector 8. In a case where the CPU 101 detects that the user hooks off the telephone set, the connection between the line and  
5 the telephone set is established by switching OFF both of the CML relay 3 and the H relay 7 and also switching OFF the H detection relay.

Herein, the non-ringing wait state can be set in the F/T selection mode and the auto receiving mode  
10 but can not be set in the manual call receiving mode.

Next, if the manual call receiving mode is not set, it is judged whether the mode is a FAX/TEL mode (a call received is FAX or telephone) or not. In the case of the telephone, the user is prompted to hook  
15 off the telephone set, and, in the case of the FAX, it is judged whether or not the mode is a auto FAX receiving mode or not (S211).

The line is captured by switching ON the CML relay 3, and both of the H relay 7 and the H  
20 detection relay 9 are switched ON (S212). The telephone set is supplied with the electricity via the diode bridge 1. Hence, the CPU 101 is capable of the hook detection involving the use of the HOOK detector 8 (S213), however, it is not meant to say  
25 that the telephone set exerts no (zero) influence on the line. Herein, when the off-hook is detected, both of the CML relay 3 and the H relay 7 are

switched OFF, the H detection relay 9 is likewise switched OFF, the operation moves to a speech. When the speech comes to an end (S215) the respective relays are initialized and the operation is  
5 terminated (S216). In the case of detecting a CNG signal without detecting the off-hook (S217), the H relay 7 is switched ON while the H detection relay 9 is switched OFF (S218), and the operation moves to the communications.

10       Herein, during the communications, the H detection relay 9 is switched OFF, and it is therefore possible to surely eliminate the influence of the telephone set.

          If judged not to be the F/T selection mode,  
15 i.e., in the case of the auto call receiving mode (it is judged that the line is used for the communications, etc.), the line is captured by switching ON the CML relay 3, the H relay 7 is switched ON, and the H detection relay 9 is switched  
20 OFF (S219). Then, the variety of relay control units are controlled so that the supply of electricity via the diode bridge 1 is not conducted. Hence, the influence of the telephone set 117 upon the communications can be completely removed. Inversely,  
25 however, the hook condition of the telephone set can not be known.

          As described above, however, it is of no



importance that the hooking cannot be even detected during the communications. The reason why not important is that it is the communication ending point of time that requires the hook detection (S220) and, if the telephone set connected to the terminal T1/T2 is meaninglessly off-hooked (S222), an off-hook alarm is merely issued. Therefore, simply, the H detection relay driving unit 111 is controlled so that the H detection relay 9 is switched ON just when judging that the communications are finished (S221), then the hook-state is detected. When the telephone set is off-hooked (S222), processing in step S216 is executed.

Further, if it is judged that auto dialing for the FAX communications is done (S224), the line is captured by switching ON the CML relay 3, the telephone set is disconnected from the line by switching ON the relay 7, and the H detection relay 9 is switched OFF (S225). Then, the supply of electricity via the diode bridge 1 is not carried out. Thereafter, although the dial signal is transmitted, this does not need to detect the hooking either, and hence the CPU 101 does not perform the hook detection. Herein, the reason why the hook detection is not done is that it is improbable to discontinue the dialing operation midway by on-hooking the telephone set connected to the terminal T1/T2.

In the case of noticing an input mistake after inputting the telephone number by dialing from the FAX side (S226) in the state where the telephone set connected to the T1/T2 is off-hooked, the user again  
5 off-hooks the telephone set after temporarily returning the telephone set, and inputs a correct telephone number. According to the configuration described above, however, the hook-state of the telephone set connected to the terminal T1/T2 cannot  
10 be detected during dialing, and therefore the CPU 101 on the apparatus side does not notice that the telephone set has been off-hooked. Therefore, the mis-inputted telephone number is dialed from the FAX side, and subsequently the telephone number re-  
15 inputted by the user is dialed from the FAX side.

Then, the exchanger is bound to establish the connection to the telephone number dialed for the first time, and hence there arises a problem in which the telephone set is connected to the telephone  
20 number dialed for the first time in spite of redialing by the user.

Next, the off-hook dialing operation in the present embodiment will be described.

FIG. 11 is a flowchart showing the off-hook  
25 dialing operation in the present embodiment. This operation is executed by the CPU 101 reading the program stored on the R 102. The CPU 101 controls

the CML relay driving unit 109, the H relay driving unit 110 and the H detection relay driving unit 111 through the relay control unit 108, thereby executing the ON/OFF control of the CML relay, the H relay and  
5 the P relay.

The CPU 101 detects the hook-state of the telephone set 117 and judges that the off-hook dialing is started by an operation of the operation unit 116. In this case, in S301, the CPU 101  
10 initializes the relays. Herein, the line is captured by switching ON the CML relay 3, and the P relay 2 is switched OFF, thus providing a signal transmissible state. Then, the H relay 7 is switched ON, the telephone set is disconnected from the line, the H  
15 detection relay 9 is switched OFF, and there is set a state where the connection via the diode bridge 1 is not established.

In S302, the dialing for one digit is made. A dialing method is known and therefore a detailed  
20 explanation thereof is not given herein. In the case of DTMF (Dual Tone Multiplexed Frequency), a DTMF signal is transmitted from the MODEM 107. In the case of pulses, after switching ON the P relay 2, the CML relay 3 is switched OFF, and an influence of the  
25 transformer 4 is eliminated. Thereafter, the P relay 2 is switched OF/ON, thereby generating the pulses. After generating a desired number of pulses, the CML

relay 3 is switched ON while switching OFF the P relay 2, and the dialing for one digit comes to an end.

FIG. 12 is a timing chart showing the  
5 operations in the embodiment described above.

In S303, it is checked whether or not the dialing for all the digits has been finished. If the dialing for all the digits has been finished, the dial processing is terminated. If the dialing for  
10 remaining digits is not yet done, the processing proceeds to step S304.

In S304, it is checked whether the dialing is off-hook dialing or not. If other than the off-hook dialing, the hook detection is not required and is  
15 not therefore carried out. In S306, after waiting for only a given pause between digits (which might be expressed such as an inter-digit pause time), the processing makes a loopback to step S302, and the dialing continues. Herein, the reason why the hook  
20 detection is not needed if other than the off-hook dialing, is that a halfway discontinuation of the dialing is detected by detecting that an unillustrated stop key is pressed, a hook key is operated and so on.

25 When judging in S304 that the dialing is the off-hook dialing, it is checked in S305 whether a communication start instruction is received or not.

According to the present embodiment, when the user presses a start key, it is judged that the communication start instruction has been received. In the case of having received the communication  
5 start instruction, hereafter a halt of the dialing operation is done by the unillustrated stop key of the operation unit 116, and therefore the hooking of the telephone set is not detected. Hence, there is the wait for only the inter-digit pause time in S306,  
10 and thereafter the processing makes the loopback to step S302, wherein the dialing continues.

When judging in S305 that the communication start instruction is not received, in S307, the H detection relay 9 is switched ON, and the hook  
15 detectable state is thus prepared. In S308, there is a wait for only a given inter-digit pause time, and thereafter, the HOOK1 signal is checked in S309. Herein, if in the off-hook-state, the H detection relay 9 is switched OFF in S310, and the processing  
20 returns to S302, wherein the dialing continues.

When judging in S309 that the state is the on-hook-state, there is a wait for an arbitrarily given period of time in S311. According to the present embodiment, it is assumed that this arbitrarily given  
25 period of time be 500 ms. It is checked in S312 whether the on-hook is confirmed or not. In the present embodiment, the hook determination is made in

a task different from the dialing, and the control in an execution task for dialing is performed by referring to a result of the determination. A hook determining method will hereinafter be explained.

5           When judging in S312 that the on-hook is confirmed, the dial processing comes to an end. Whereas if the on-hook is judged to be unrecognized, the processing goes back to S309, wherein the HOOK1 signal is rechecked. Hereafter, a loop of processing  
10 in S309 to S312 is repeated till the on-hook is confirmed or the HOOK1 signal reverts to the off-hook-state.

What has been discussed so far is the operation of the dial processing in the present embodiment.

15           Next, hook determination processing in the present embodiment will be described.

FIG. 13 is a flowchart showing an operation of the hook determination processing in the present embodiment. This operation is executed by the CPU  
20 101 reading the program stored on the ROM 12.

The hook determination processing is executed in a period task having a period of 1 ms, and variables are initialized before starting the processing.

25           The variables used in the present embodiment include a variable Result stored with the result of the hooking, an ON-timer for recognizing the on-hook

and an OFF-timer for recognizing the off-hook. The variable Result is initialized at ON. The ON-timer is initialized at 2200. The OFF-time is initialized at 200. Namely, this process is executed with the  
5 period of 1 ms. Therefore, the on-hook is recognized in 2.2 s, and the off-hook is recognized in 0.2 s.

To start with, it is checked in S401 whether the H relay 7 is switched ON or not. If switched ON, it is checked in S402 whether the H detection relay 9  
10 is switched ON or not. If the H detection relay 9 is judged ON, the telephone set is supplied with the electricity from the line via the diode bridge 1 → the H detection relay 9 → the H relay 7 in this sequence, whereby the HOOK detector 8 becomes capable  
15 of detecting the hooking. Hence, the HOOK1 signal is read in S404, and the processing advances to step S406.

When detecting in S402 that the H detection relay 9 is switched OFF, the hook detection is unable  
20 to be done, and therefore the hook determination processing is finished. At this time, the variables such as Hook Result, etc. are not updated, and hence the result acquired when being possible of the hook detection is taken over.

25 When judging in S401 that the H relay 7 is switched OFF, it is checked in S403 whether the CML relay 3 is switched OFF or not. If the CML relay 3

is judged OFF, the telephone set is supplied with electricity from the line via the CML relay 3 → the H relay 7 in this sequence, whereby enabling the HOOK detector 6 to detect the hooking.

5           Hence, the HOOK2 signal is read in S405, and the processing proceeds to step S406. When detecting in S403 that the CML relay 3 is switched ON, the hook detection is unable to be done, and therefore the hook determination processing is finished. At this  
10   time, the variables such as the hook result, etc. are not updated, and hence the result acquired when being possible of the hook detection is taken over.

          It is judged in S406 whether the hook result read in step S404 or S405 is ON or OFF. If the hook  
15   result is ON, it is checked in S407 whether the read result of the last time is ON or not. If judged ON last time also, a value of the ON-timer is checked in S410. If the value of the ON-timer is larger than 0, the value is decremented by 1 in S413. It is checked  
20   in S415 whether a decrement result is 0 or not. If the decrement result is 0, ON is written to the variable Result in S417.

          In S410, if the value of the ON-timer is 0, ON has already been written to the variable Result, and  
25   hence the processing from this step onwards is not executed but terminated. In S415, if the value of the ON-timer is larger than 0, this implies that the



recognition is underway, so that the processing comes to an end without updating the variable Result.

Further, in S407, if judged not to be ON last time, this indicates a change to ON from OFF this  
5 time. Therefore, for starting an ON's examination, in S409, the initial value of 2200 is written to the ON-timer, thus finishing the processing.

In the way described above, the on-hook is recognized only when ON continues during a period of  
10 2200 ms since the result of the HOOK1 signal or HOOK2 signal changed to ON from OFF, and the variable result is updated to ON. The variable Result is not updated in cases other than the above-mentioned.

The recognition of the off-hook is made in the  
15 same way as it has been done above, wherein if judged OFF in S406, it is checked in S408 whether the read result of the last time is OFF or not. Then, if judged OFF last time also, the OFF-timer is checked in S411, and, if the value of the OFF-timer is larger  
20 than 0, the value is decremented by 1 in S414.

Subsequently, if the decrement result is 0 in S416, OFF is written to the variable Result in S418. When judging in S411 that the value of the OFF-timer is 0, OFF has already been written to the variable  
25 Result, and therefore the processing from this step onwards is not executed but finished.

When judging in S416 that the value of the OFF-

timer is larger than 0, the recognition is underway, so that the variable Result is not updated, and the processing comes to an end.

Further, in S408, if judged not to be OFF last  
5 time, this indicates a change to OFF from ON this time. Therefore, for starting an OFF's examination, in S412, the initial value of 200 is written to the OFF-timer, thus finishing the processing.

The operation described above is the hook  
10 determination processing.

In S312 of the dial processing flow shown in FIG. 11, the variable Result is read, and it is judged whether an end of the dialing is possible or impossible.

15 According to the present embodiment, in the off-hook dialing, the influence of the telephone set is eliminated by switching OFF the H detection relay in the process of dialing. At the same time, the H detection relay is switched ON in the inter-digit  
20 time of dialing, whereby the hook-state of the telephone set can be detected.

Further, as the inter-digit time of dialing is quite short, it is difficult to surely judge the on-hook. For instance, according to NTT's technical  
25 data, a discriminating time of a disconnection signal is equal to or larger than 0.3 s at a hooking non-allowable time and equal to or larger than 2.2 s at a

hooking allowable time. In the case of DTMF, however,  
the inter-digit pause time is merely on the order of  
several tens milliseconds (ms) through one hundred  
several tens milliseconds (ms) and, even in the pulse  
5 dialing, on the order of several hundreds  
milliseconds (ms).

Such being the case, according to the present  
embodiment, in the case of detecting the on-hook-  
state for the inter-digit time of dialing, a  
10 sufficient hook detection time is gained by delaying  
the dialing of the next digit, thereby scheming to  
improve an accuracy of the hook detection.

Moreover, if the user indicates the FAX  
transmission by pressing the start key, etc. after  
15 inputting the dial in the off-hook-state, normally  
the user immediately returns the telephone set, and  
consequently the dialing is finished halfway,  
resulting in such a possibility that the FAX  
transmission is not executed. This being the case,  
20 according to the present embodiment, when receiving  
the transmission start instruction from the user, the  
hook detection is not performed for the inter-digit  
time, thereby further enhancing the utility.

The present invention exhibits a remarkable  
25 effect, wherein the apparatus can be provided at the  
low costs by utilizing the current flowing from the  
line to execute the hook detection.

The present invention exhibits an effect, wherein the influence of the telephone set upon the communications can be completely eliminated during the communications and the dialing as well.

5       The present invention exhibits an effect, wherein in the facsimile apparatus having no DC power source for the exclusive use for the hook detection, the hook-state in the off-hook dialing can be surely detected, and there can be removed the possibility of  
10 mis-dialing in such a case that when after dialing from the FAX side in the off-hook-state of the telephone set, the mistake in inputting the telephone number is noticed, the correct telephone number is inputted and after on-hooking the telephone set, the  
15 telephone set is off-hooked.

The present invention exhibits an effect, wherein the influence of the telephone set upon the communications can be completely eliminated during the dialing.

20       The present invention exhibits an effect, wherein in the case of judging whether the call received is directed to the telephone or the facsimile, when the telephone set is off-hooked, the hooking can be surely detected even the hook  
25 detection is conducted based on the line current.

The present invention exhibits an effect, wherein when the non-ringing receipt mode is set, the

call can be received without causing the telephone set to ring by rectifying the call receiving signal, and, in the case of off-hooking the telephone set, the hooking can be surely detected even if the hook  
5 detection is executed based on the line current.

The present invention exhibits an effect, wherein the hook-state in the off-hook dialing can be surely detected even in the case of executing the hook detection based on the line current, and it is  
10 possible to certainly eliminating the possibility of mis-dialing in the case of noticing the mistake in inputting the telephone number after dialing from the side of the communication apparatus in the off-hook-state of the telephone set.

15 The present invention exhibits an effect, wherein the hook detecting means can be for sure supplied the electricity without receiving the ON/OFF influence of the first switch means by disposing the second switch means closer to the line than the first  
20 switch means.

The present invention exhibits an effect of being capable of corresponding to the ringing call receiving mode even when the second hook detecting means cooperating with the third switch means detects  
25 the hooking from the line current.

The present invention exhibits an effect of being capable of completely eliminating the influence

of the telephone set upon the communications during the communications.

The present invention exhibits an effect, wherein the capture of the line after finishing the communications can be detected even in the case of  
5 the performing the hook detection based on the line current, and it is therefore possible to prevent a futile line connection from being established when the handset of the telephone set comes off by mistake.

10 The present invention exhibits such a remarkable effect that the apparatus can be provided at the low costs by utilizing the current flowing from the line and executing the hook detection. Another effect is that the influence of the telephone  
15 set upon the communications can be completely removed during the communications and the dialing. A further effect is that in the case of judging whether the call received is directed to the telephone set or the facsimile, if the telephone set is off-hooked, the  
20 hooking can be surely detected even when the hook detection is done based on the line current. In the case here the non-ringing call receiving mode is set, the call can be received without causing the telephone set to ring.